INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT

LIGHTWEIGHT DYNAMIC CONE PENETROMETER TESTING OF FLOWABLE BACKFILL ITM No. 216-08T

1.0 SCOPE.

1.1 This test method covers the procedure for the determination of the blow count penetration resistance of flowable backfill using the lightweight dynamic cone penetrometer.

1.2 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101, and as follows:

2.1. Penetration resistance blow count. The number of blow counts of a drop hammer that is required of the penetrometer cone to penetrate the flowable backfill to the first reference mark of the lightweight dynamic cone penetrometer.

3.0 SIGNIFICANCE AND USE.

3.1 This ITM is used to assess the laboratory and in-situ strength of flowable backfill to ensure that the flowable backfill provides sufficient support for use as a fill material.

3.2 Other test procedures or test methods are available for various dynamic cone penetrometers with different hammer weights and cone tip forms and sizes that may or may not have a correlation with the lightweight dynamic cone penetrometer described in this ITM.

4.0 APPARATUS. The lightweight dynamic cone penetrometer (Appendix A) is a device which characterizes the state of strength of flowable backfill through a measure resistance to penetration by a sharp pointed cone. The lightweight dynamic cone penetrometer is a 11/16 in. diameter steel rod onto which an upper handle and a steel collar are permanently fastened. A 5 lbm steel drop hammer is located between the handle and coupler assembly on the steel rod. The distance from the bottom of the hammer to the coupler assembly is 20 in. On the bottom of the rod is a replaceable hard sharp conical tip with an included angle of 23.3° ± 0.3°. On the rod slightly above the cone point are two reference lines. The first reference line is 3 1/4 in. above the back of the cone point and the second reference line is 3 1/4 in. above the first reference line. The second reference line is not used in this test.

5.0 SAMPLE PREPARATION. The lateral dimension of the sample shall be at least 2 ft, and the height of the sample shall be at least 6 in. If a laboratory sample is used, the container shall not be watertight.

6.0 PROCEDURE.

6.1. Place the screw-in cone tip on the end of the steel rod

6.2 Place the dynamic cone penetrometer cone point on the surface of the prepared sample at least 3 in. from the edge of the sample. Hold the penetrometer in a vertical or plumb position.

6.3 Raise the drop hammer to the handle flange and allow the hammer to free-fall down the rod and impact the collar. Each lift and drop of the hammer is calculated as one blow count.

6.4 Drive the cone into the flowable backfill until the surface of the flowable backfill is at the first reference line on the rod

6.5 Record the number of blow counts as N_1

6.6 Repeat 6.2 through 6.5 at two different locations to acquire the additional readings of N_2 and N_3. The distance between these additional locations shall be at least 3 in.

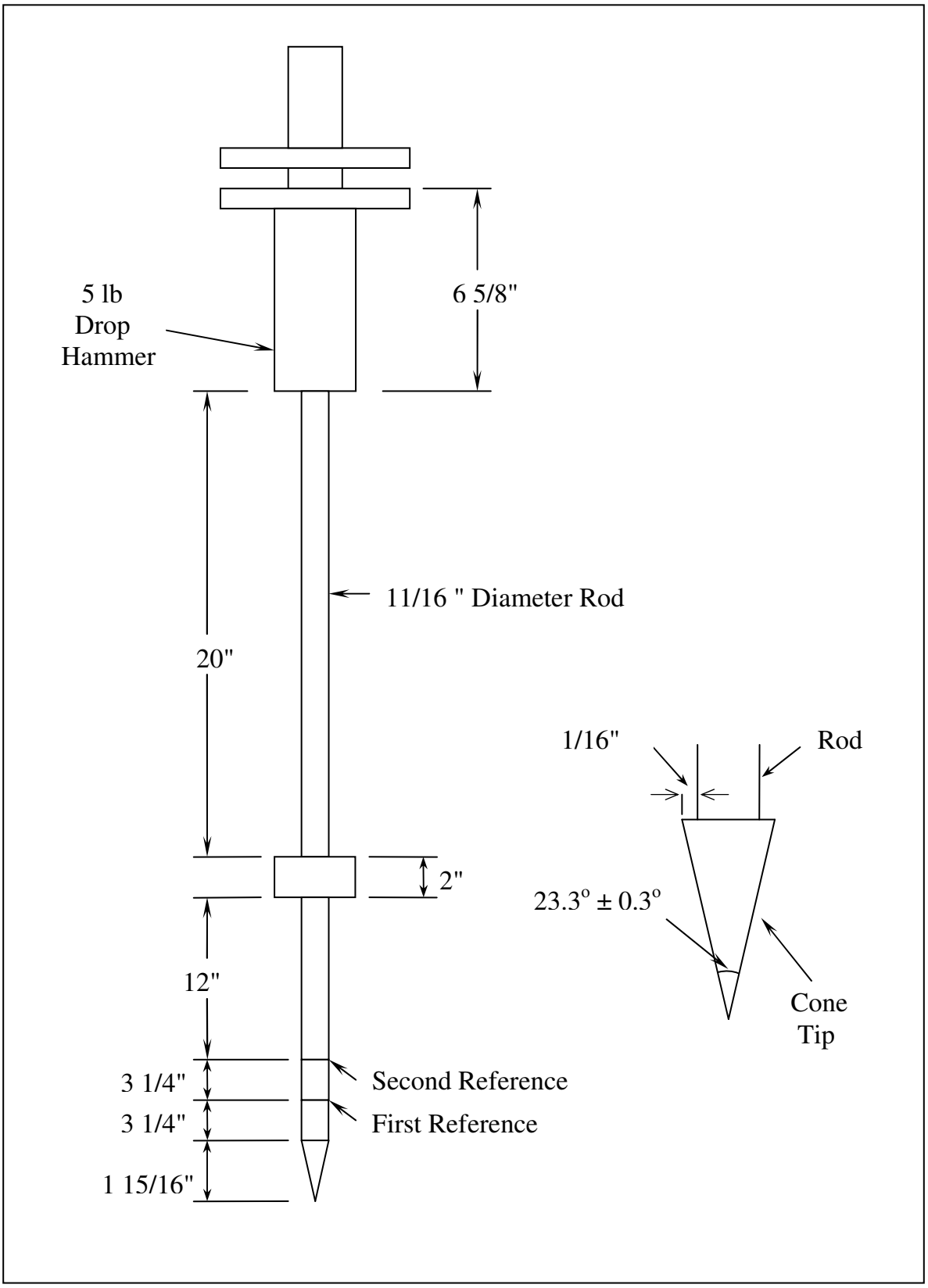
7.0 CALCULATIONS. Calculate the average penetration resistance blow count as follows:

$$N_{avg} = \frac{N_1 + N_2 + N_3}{3}$$

where:

N_{avg} = average penetration resistance blow count
N_1 = penetration resistance blow counts at first test location
N_2 = penetration resistance blow counts at second test location
N_3 = penetration resistance blow counts at third test location

8.0 REPORT. Report the average penetration resistance blow count to a whole number.


5 lb
Drop
Hammer
6 5/8"
11/16 " Diameter Rod
20"
2"
12"
3 1/4"
3 1/4"
1 15/16"
Second Reference
First Reference
1/16"
Rod
23.3° ± 0.3°
Cone
Tip